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**LASER DAMAGE AND EFFECTS BIBLIOGRAPHY**

**Part 1. Journal Literature through 1982**

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United States Naval Academy**

**USNA-MS-01-84**

**UNITED STATES NAVAL ACADEMY  
DIVISION OF  
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ANNAPOLIS, MARYLAND**

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Part I. Journal literature through 1982

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15 June 1984

Interim Report on a Continuing Bibliography

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Naval Research Laboratory  
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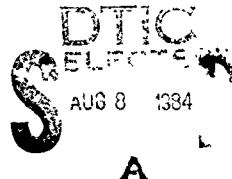
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LASER DAMAGE AND EFFECTS BIBLIOGRAPHY  
PART I - Journal Articles Through 1982

I. Background

In 1958, C. H. Townes and A. L. Schawlow proposed a coherent light generator, originally termed an "optical maser", later, a "laser". The growth of literature on the laser was rather slow until 1960, where T. H. Maiman reported his work on the ruby laser. After that, many workers entered the field and the literature burgeoned.

In subsequent years several extensive bibliographies on lasers were published. Kiyo Tomiyasu compiled five collections of laser-related references which were published in the IEEE Journal of Quantum Electronics in issues dated from June 1965 through July 1967. In 1968 a revised and augmented version was published by the Plenum Press as The Laser Literature--An Annotated Guide. Although the "annotation" was minimal, the articles were conveniently categorized into 27 subject groups. Of these, there were three which contained material of interest in the domain of "Laser Damage and Effects", namely, no. 22 "Gas Breakdown", No. 23 "Other Nonlinear, Thermal, and Interaction Effects with Matter", and No. 24 "Transmission, Propagation, Scattering, Reflection, and Filtering". Of the 3990 references in Tomiyasu's bibliography, categories 22, 23, and 24 contained 59, 260, and 310 entries, respectively.

In 1967, Western Periodicals Co., North Hollywood, California, published a two-volume bibliography by Edward V. Ashburn. It was called Laser Literature--A Permuted Bibliography 1958-1966. The "permutation" feature involved a computerized cyclic rotation of the words of the reference titles to permit easy identification of articles whose titles contain a particular word. Basically it gave in print what a title word search would yield.

In his forward, Ashburn has a table which is worth reproducing here. It lists the number of laser papers published per year from 1958 through 1965. I have added a column of cumulative totals.

<u>Year</u>	<u>Number/Year</u>	<u>Cumulative Total</u>
1958	2	2
1959	6	8
1960	17	25
1961	136	161
1962	304	465
1963	752	1217
1964	957	2174
1965	1290	3464

Since he includes a partial listing of articles from 1966, Ashburn's bibliography contains a total of 4357 entries obtained from monographs, published proceedings of symposia, and 350 journals.

Some later bibliographies have been prepared of a general nature, of which the Defense Technical Information Center (DTIC) effort is the most considerable. As might be expected, technical reports dominate DTIC's entries. Searches in DTIC can be made by author and title, but also by keywords. Unfortunately, the

keywords lack finesse and a search net for a particular kind of material frequently lets important material slip by or accumulates an unwieldy mass of references most of which are of no concern for the project.

An alternative to this general approach is the establishment of more specialized bibliographies. Claudio De Michelis published an article in the April 1969 issue of the IEEE Journal of Quantum Electronics titled "Laser Induced Gas Breakdown: A Bibliographic Review", which contained 161 entries on this more specialized topic. The following year, in the October 1970 issue of this same journal, two additional specialized bibliographies were published, one, again by Claudio De Michelis, "Laser Interaction with Solids - A Bibliographic Review", containing 212 entries, and the other, by A. M. Robinson and Derwyn C. Johnson, "A Carbon Dioxide Laser Bibliography 1964-1969," containing 450 entries. C. A. Pitha published a specialized bibliography, Laser Damage: A Selected Literature, as an Air Force Cambridge Research Laboratory Special Report 60, February 1967.

There are also hard-bound press-published specialized bibliographies. A good example of this is Laser Window and Mirror Materials published in 1977 by IFI/Plenum Data Company as vol. 9 of their Solid State Physics Literature Guides. G. C. Battle, Tom Connolly, and Anne M. Keesee of the Solid State Division, Oak Ridge National Laboratory compiled this bibliography. There are 780 entries, an author index, and a title permutation feature.

The wealth of laser literature dictates more specialized bibliographies such as the two cited above. But caution must be exercised in compiling specialized bibliographies, since not infrequently material in an article devoted largely to one topic will include matter of importance to a rather different topic. In this regard, particularly, the contents of an article are rarely entirely revealed by its title - despite the length of some! Thus the title word permutation scheme employed in some bibliographies, though helpful, is not adequate. The keyword scheme used by DTIC offers more promise and, in fact, a rather elaborate computerized key system was designed for the present Laser Damage and Effects Bibliography. The details of this tree-type keying system, which is designed specifically for computer searches, will be detailed in a separate technical report.

## II. Introduction

The computerized "Laser Damage and Effects Bibliography" was designed to be a research tool, in that for particular aspects of the general field of laser damage and effects it would be possible to perform a computer selective search and retrieve from a rather large and unwieldy bibliography (such as is in the present technical report) only those articles of particular concern. It was to be a reference source on what had been done and published in the field of interest, reducing considerably the time which might be spent on a standard literature search and, perhaps, avoiding the repetition of work already published.

In any specialized bibliography there is the ever-present problem of what to include. There are two aspects of this problem, namely, to include everything that is significant and to exclude what is not significant. If a compiler is to err, it would seem best to include too much than to omit an important article. Often the choice becomes one of a personal nature or even a matter of chance.

First of all, I began collecting articles in order to become familiar with what was for me a new field. Thus I began rather unsystematically, reading recent articles and then following backwards using their citations and references. I either obtained reprints or made copies of all references and, in fact, made it a first principle that every item in the bibliography was readily at hand for my reference. This I have adhered to, which means, first of all, many volumes of bulging large-sized three-ring notebooks for the articles as well as file cabinets for the 8" by 5" file cards, one card for each entry, with the information and keying used to transfer to the computer. Secondly, it means that an article in one of the more obscure journals can slip by my attention unless I note a citation to it and can retrieve it via inter-library loan.

Since, in following up references to journals, I began to see my name on the library card of many volumes more than once, I began to more systematically look through an entire volume once I took it out to copy a single reference. That way I could check off that volume on my list with some assurance that I wouldn't have to carry it more than once from the library to my office and back again.

The emphasis initially was laser damage. But what was involved in laser damage seemed to extend rather considerably. To damage a material, the laser beam had to reach it. Thus transmission through the atmosphere became of significance. The effect of the formation of a plasma at a target was important, so laser-formed plasmas had to be considered. The theory of the laser-target and plasma-target interaction was important, so the work done in the fields of material processing using lasers and the higher energy laser fusion work impinged. It was difficult sometimes to decide what among the more ancillary fields should be included. I tried to include anything the effect of which or the theory of which might shed light on the problem of laser damage, but I made no attempt to be complete in either material processing, such as laser annealing of semiconductors, or laser fusion experiments, or chemical effects, even though there are included a number of entries which deal primarily with these fields.

Again, the bibliography is computer key-oriented, so a bare listing, such as in this report, is of relatively limited value. Nevertheless, it may

prove of some service as is. A limited breakdown into categories is included as an aid. The general categories used here are based on primary emphasis, but are not absolutely clear cut.

- I General laser damage and energy/momentum coupling
- II Damage to optical materials
- III Laser plasma formation and characteristics
- IV Transmission and optical phenomena
- V Material testing/processing and applications
- VI Laser fusion related
- VII Bibliographies, background material and books.

Within each category, the entries are listed first by year published, then by principal author alphabetically.

Again, the primary emphasis of this bibliography is "Laser Damage". The most directly applicable entries will thus be found in Categories I and II, and it is here that I have made the greatest effort toward completeness. The ancillary, but, in some cases, very pertinent material found in the other categories fall under the more general classification "Laser Effects". Although the entries in these other categories are far from complete, the number included is large enough that this bibliography may perhaps be of some service to workers in those fields.

As a final note, this bibliography is continuing to grow, not only as new papers are being published, but as I continue to fill in gaps. In this regard, the services of readers is solicited to call to my attention serious omissions. In addition, I have started on the second phase of this bibliographic work, namely, the inclusion of unclassified technical reports. This is a rather awesome undertaking since I already have several shelves of technical reports and I have hardly begun. Nevertheless, since a greater and greater fraction of the work on laser damage is being reported in technical reports rather than the archival journal literature, it behooves me to move in that direction. A third phase is the inclusion of classified technical reports. Fortunately, since much of this is hardware oriented, its value to the general field of laser damage and effects is much less than what is to be found in the open literature (including unclassified technical reports). That fact, and the technical difficulties of handling references to classified material on a computer, place this project third and of lowest priority.

## I. General Laser Damage and Energy/Momentum Coupling

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Appl. Phys. Lett. 3 (15 Jul 63) 25-27

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"Laser-Formed Apertures for Electron Beam Instruments"  
J. Appl. Phys. 34 (Dec 63) 3640-3641

READY, J. F.  
"Development of Plume of Material Vaporized by Giant-Pulse Laser"  
Appl. Phys. Lett. 3 (1 Jul 63) 11-13

WHITE, R. M.  
"Elastic Wave Generation by Electron Bombardment or  
Electromagnetic Wave Absorption"  
J. Appl. Phys. 34 (Jul 63) 2123-2124

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CAROME, E. F.; CLARK, N. A.; MOELLER, C. E.  
"Generation of Acoustic Signals in Liquids by Ruby Laser-Induced  
Thermal Stress Transients"  
Appl. Phys. Lett. 4 (15 Mar 64) 95-97

CHANG, T. Y.; BIRDSALL, C. K.  
"Laser-Induced Emission of Electrons, Ions, and Neutrals from Ti  
and Ti-D Surfaces"  
Appl. Phys. Lett. 5 (1 Nov 64) 171-172

ISENOR, N. R.  
"Metal Ion Emission Velocity Dependence on Laser Giant Pulse  
Height"  
Appl. Phys. Lett. 4 (15 Apr 64) 152-153

NEUMAN, Frank  
"Momentum Transfer and Cratering Effects Produced by Giant Laser  
Pulses"  
Appl. Phys. Lett. 4 (May 64) 167-169

SOOY, W. R.; GELLER, M.; BORTFELD, D. P.  
"Switching of Semiconductor Reflectivity by a Giant Pulse Laser"  
Appl. Phys. Lett. 5 (1 Aug 64) 54-56

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KROKHIN, O. N.; KRYUKOV, P. G.; SENATSKII, Yu. V.; STOILOV, Yu. Yu.  
"Heating of Matter by Focused Laser Radiation"  
Sov. Phys. JETP 21 (Dec 65) 1061-1064

BIRNBAUM, Milton  
"Semiconductor Surface Damage Produced by Ruby Lasers"  
J. Appl. Phys. 36 (Nov 65) 3688-3689

BUNKIN, F. V.; FEDOROV, M. V.  
"Cold Emission of Electrons from the Surface of a Metal in a  
Strong Radiation Field"  
Sov. Phys. JETP 21 (Nov 65) 896-899

CHANG, I-Dee; RUSSELL, P. E.  
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Phys. Fluids 8 (Jun 65) 1018-1026

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IEEE J. Quantum Electron. QE-1 (Nov 65) 359-360

READY, J. F.  
"Effects Due to Absorption of Laser Radiation"  
J. Appl. Phys. 36 (Feb 65) 462-468

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Pendulum"  
J. Appl. Phys. 36 (Aug 65) 2598-2599

VERBER, C. M.;ADELMAN, A. H.  
"Laser-Induced Thermionic Emission from Tantalum"  
J. Appl. Phys. 36 (May 65) 1522-1525

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"Application of Electron and Optical Microscopy in Studying  
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J. Appl. Phys. 36 (Dec 65) 3697-3701

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under the Influence of an Unfocused Laser Beam"  
Sov. Phys. JETP Lett. 4 (1 Sep 66) 122-123

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Physics of Quantum Electronics, Conf. Proc., 28-30 Jun 65,  
San Juan, Puerto Rico; Eds. Kelley, Lax, and Tannenwald;  
(McGraw-Hill, 1966) 489-498

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Sov. Phys. JETP 22 (Apr 66) 844-847

FLORENCE, A. L.

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Int. J. Solids Structures 2 (1966) 37-47

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"Momentum Transfer Produced by Focused Laser Giant Pulses"  
J. Appl. Phys. 37 (Jun 66) 2787-2789

KOROBKIN, V. V.; SEROV, R. V.

"Investigation of the Magnetic Field of a Spark Produced by  
Focusing Laser Radiation"  
Sov. Phys. JETP Lett. 4 (1 Aug 66) 70-72

MURPHY, James; RITTER, George J.

"Laser-Induced Damage in Copper Crystals"  
Appl. Phys. Lett. 9 (1 Oct 66) 272-273

PERESSINI, E. R.

"Field Emission from Atoms in Intense Optical Fields"  
Physics of Quantum Electronics, Conf. Proc., 28-30 Jun 65,  
San Juan, Puerto Rico; Eds. Kelley, Lax, and Tannenwald;  
(McGraw-Hill, 1966) 499-508

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"Evaluation of Energy Parameters in the Laser Welding of Metals"  
Sov. Phys. Dokl. 10 (Jan 66) 659-661

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"Expansion Rates of the Luminous Front of a Laser-Produced Plasma"  
Appl. Phys. Lett. 9 (1 Nov 66) 334-337

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AFANAS'EV, Yu. V.; KROKHIN, O. N.

"Vaporization of Matter Exposed to Laser Emission"  
Sov. Phys. JETP 25 (Oct 67) 639-645

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IMAS, Ya. A.; PAVLENKO, N. A.; ROMANOV, G. S.

"Effect of Powerful Light Fluxes on Metals"  
Sov. Phys. Tech. Phys. 11 (Jan 67) 945-952

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STUDENOV, V. B.

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Matter"

Sov. Phys. JETP Lett. 5 (15 Feb 67) 93-95

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"Formation of Shock Waves with the Aid of Powerful Laser  
Radiation"

Sov. Phys. JETP Lett. 6 (15 Sep 67) 168-171

BRIENZA, M. J.; DeMARIA, A. J.

"Laser-Induced Microwave Sound by Surface Heating"

Appl. Phys. Lett. 11 (15 Jul 67) 44-46

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"Some Features of the Interaction Between Short Laser Radiation  
Pulses and Matter"

Sov. Phys. JETP 25 (Dec 67) 1072-1075

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"Ferroelectric Effect in a Laser Beam"

Sov. Phys. JETP Lett. 5 (1 Jan 67) 14-17

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"Similarity Between Physical Processes in a Pulsed Discharge and  
in the Effect of Laser Radiation on a Metal"

Sov. Phys. Tech. Phys. 12 (Dec 67) 846-849

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"Absorption of Laser Radiation and Damage in Semiconductors"

Sov. Phys. Solid State 9 (Nov 67) 1085-1090

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"Destruction of Ruby and Leucosapphire Crystals by Strong Laser  
Radiation"

Sov. Phys. JETP 24 (Mar 67) 516-518

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"Self-Focusing of Laser Beams in Ruby and Leucosapphire Crystals"

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High Temp. 6 (Jan-Feb 68) 110-114

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